

A review of the *Voluta polypleura* - *demarcoi* complex

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ABSTRACT The *Voluta polypleura* - *demarcoi* species complex of the Caribbean Province volutid fauna are reviewed, illustrated, and a number of taxa are revised.

KEY WORDS Volutidae, *Voluta*, Caribbean Province, Nicaraguan Subprovince, allopatric species

INTRODUCTION

There has been much confusion concerning the *Voluta polypleura* - *demarcoi* complex in the literature due to the apparent loss of Crosse's holotype from 1876. As shown herein this species complex represents an endemic radiation of at least ten species of Volutidae on the isolated offshore banks and muddy coastal areas of the Nicaraguan Subprovince of the Caribbean Province. These volutes are direct developers with nonplanktonic larvae and because of this, they have become isolated on offshore banks and seamounts since the late Pleistocene, consequently they have evolved into closely related allopatric species (Petuch, 2013). A recent study of this group by Edward J. Petuch found that the name *Voluta polypleura* Crosse, 1876 was misapplied to *V. demarcoi* Olsson, 1965. The true *polypleura* has a much smaller and more compact shell and completely lacks any "music lines or musical staff pattern" on the body whorl (Crosse, 1876; Poppe & Goto, 1992; Petuch, 2013).

The apparent loss of the type specimen of *V. polypleura*, was reversed by the rediscovery of the true *polypleura* with several live specimens collected from the Caratasca Cays and Vivorillos Cays of Honduras. This led to the designation of a neotype deposited with the United States National Museum as USNM 89431 (Petuch, 2013). In researching this

complex I performed an exhaustive on-line search of major museums and was surprised to discover that the holotype of *V. polypleura* has been housed at the National Museum, Liverpool, England; its accession number is LIVCM 2.4.1885.17[124]. This makes Petuch's designation of a neotype unnecessary. It is important to note that Crosse did not have accurate locality data and therefore Petuch's specimen, which has detailed locality data, fixes the type locality as the Caratasca Cays of Honduras. Specific reference is made to the remarkably true to life original painted line drawing of Crosse and the modern photograph of the holotype of *polypleura* (Figure 1), which when compared to *V. demarcoi* shows that it is a different distinct species and removes it from synonymy with *polypleura* (see Figure 2).

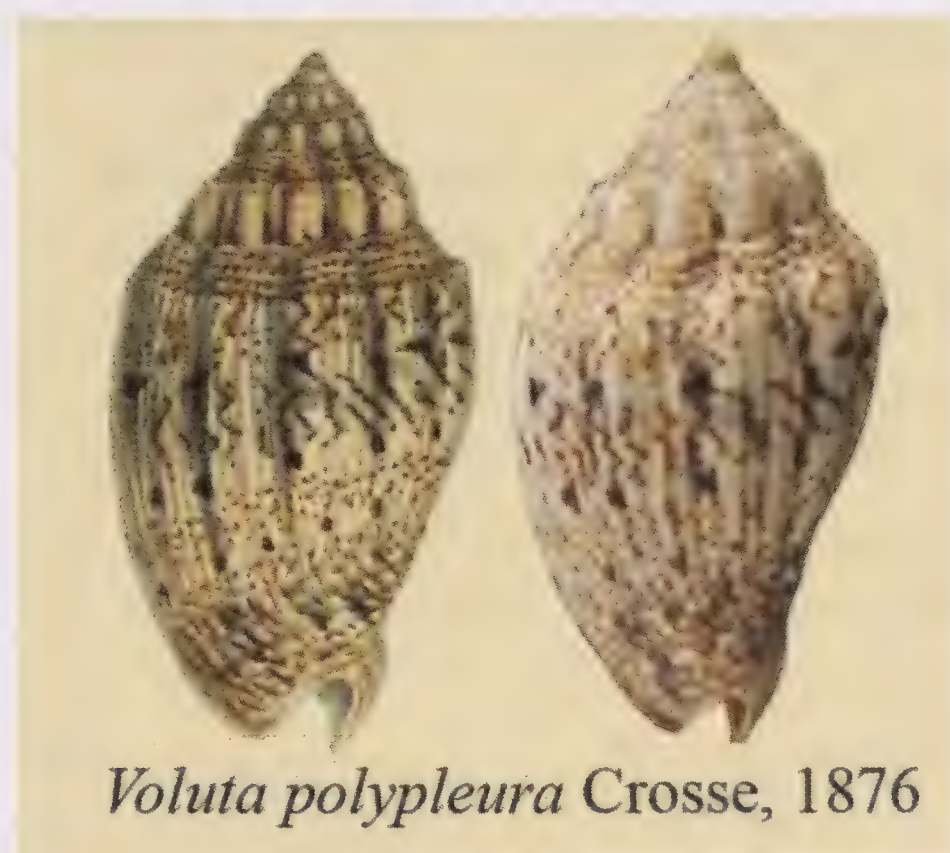


Figure 1. Original painted line drawing of the holotype of *V. polypleura* Crosse, 1876 on the left, and a modern digital photograph of the holotype on the right.

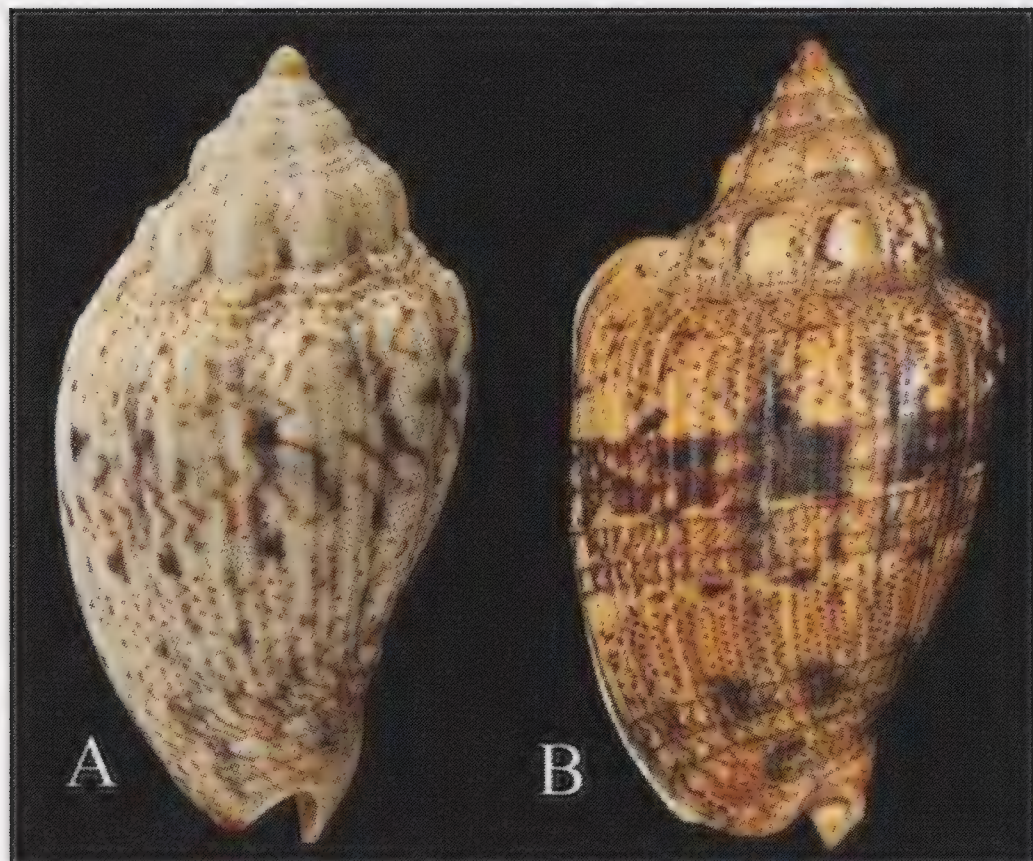


Figure 2. Comparison between species. A = *V. polypleura* holotype 56 mm, National Museum, Liverpool, England. LIVCM 2.4.1885.17[24]; B = *V. demarcoi* holotype 84.6 mm, USNM 637275. Both specimens are shown the same size in this figure for comparison.

Due to the confusion surrounding the identity of the true *V. polypleura*, a relatively rare species, photographs of the larger and more common *V. demarcoi* have been mistakenly published as *polypleura*. That mistake has now been rectified and *V. demarcoi* is recognized as a full valid species.

Color digital photographs of type specimens of all of the named species in the *Voluta polypleura* - *demarcoi* complex have been obtained and are illustrated here together with the description of each taxon.

Abbreviations.

USMN = United States National Museum

SYSTEMATICS

Gastropoda

Caenogastropoda

Neogastropoda

Volutacea

Volutidae

Volutinae

Voluta Linnaeus, 1758

SPECIES ACCOUNTS

Voluta polypleura Crosse, 1876
(Figures 1, 2A, 3A)

Holotype. National Museum, Liverpool, England. LIVCM 2.4.1885.17[124]. Length 56 mm.

Original description. "Obtuse tuberculata, lineolis transversis peculiaribus omnino carens, albida, saturate fusco maculata, castaneo multiplicata; spira mediocriter elongata, apice rotundato, obtuso, corneo; sutura subirregulariter impressa; anfractus 7, primi embryonades 2 ½, cornei, sequentes valide tuberculati, in vicinio suturae, sulcis transversis 4 impressi, ultimus ascendens, spiram superans, tuberculis in costas longitudinales desinetibus ornatus, interstitis costarum costulas minores gerentibus, versus medium zona interdum subevanida linearum castanearum, fulguratim dispositarum cinctas; apertura elongata, angusta, albida; peristoma albidum, margine columellari plicis 11 (8 validis, 3 minoribus) munito, externo albido, unicolore, maculis nigris destituto. - Long. 56 diam. maj. 30 mill. apertura longa, 10 lata." (Crosse, 1876)

Translation / Transliteration. Bluntly tuberculate, without any special crossing lines, whitish, with dark chestnut brown spots increasing; the spire moderately elongate, with rounded apex, bluntly, knobbed; suture irregularly impressed; 7 whorls, 2½ nuclear whorls, shoulders with knobs following the early whorls, sutures in the area between whorls, small spots across the 4 upper whorls tops, upper whorls have knobs on the longitudinal ribs, the space between the knobs increasing with growth, a band of chestnut brown irregular lines or flammules near the middle of the body whorl, aperture long, narrow, whitish; 11 white columellar plicae (8 major, 3 minor) strong external margins white, uniform color, dark

spots fading - 56 mm long, aperture 30 mm long, 10 mm wide.

Revised Description. Protoconch large, bulbous, consisting of 3 whorls, colored tan-brown; spire high; suture weakly defined; subsutural area ornamented with 3-4 coarse spiral cords; shoulder smooth, rounded; body whorl with 8-9 rounded axial ribs which form weak knobs on the shoulder, minor growth lines or plications between the axial ribs; outer lip adherent to the side of the body whorl, rounded, thickened; columella with 8 large smooth plications and 3 minor plications; base shell color, aperture and columella creamy white; body whorl with 2 bands of longitudinal medium brown zigzag flammules with intermittent dark brown spots above and below the band; one major band around mid-body, one minor band around anterior end; base color on body whorl and spire whorls overlaid with scattered patches of small brown dots.

Distribution. Endemic to the Caratasca and Vivorillo Cays, Honduras (Petuch, 2013).

Discussion. Despite being the oldest named species in the complex *V. polypleura* remained an enigma for over a century because the holotype was lost or misplaced and Crosse did not have accurate locality data. With the rediscovery of the holotype it is clear that this rare and elusive species significantly differs from its often confused sister species *V. demarcoi* in that it has a smaller more compact shell, narrower more rounded shoulder, and completely lacks any of the fine lines around the body whorl that are considered to be a diagnostic feature in many of these volitid species. Given that the holotype has been located in Liverpool the designation by Dr. Petuch of a neotype, which he deposited with the United States National Museum, is moot.

Voluta demarcoi Olsson, 1965
(Figures 2B, 3B)

Holotype. USNM 637275.
Length 84.6 mm.

Description. "The shell is medium or large size, ovate, solid, with an elevated spire, of about six whorls (including the nuclear ones) about half the length of the aperture. The protoconch is relatively large, bulbous or cap shaped composed of about 1½ turns, and in the type specimens colored a pale rosy brown. All whorls have rounded shoulders, and on the body whorl, the shoulder is placed high, opposite to the end of the aperture; on the whorls of the spire, the shoulder lies a little above the middle. The body whorl is large, subelliptical, forms most of the surface, and is only a little longer than the length of the aperture, its shoulder bearing about eight low nodes which fade-out below. There are similar shoulder nodes on all the whorls of the spire and appear larger as they undulate the whole visible surface. Suture are widely appressed, the zone sculpted with coarse, spiral cords. In addition to the shoulder nodes, the surface of the body whorl is covered with smaller axials or longitudinal ridges resembling enlarged, crowded growth lines. Coarse spiral threads cover the sutural zone and around the base of the body whorl. The spirals are particularly strong on the whorls of the spire, encroaching lower to cover the shoulder nodes as well. The aperture is elongate, the outer lip thickened in the adult, its margin within smooth. A series of long lirae or plaits (about 14) cover the length of the inner lip, the two lowest being the strongest, narrower and weaker above, some with a tendency of alternating in size. There is a spread of callus over the parietal wall outward. The base color is a mellow rose or pinkish brown, overlain by a zoned pattern of large, brown blotches crisscrossed by brown lines and small brown spots. The anterior canal is short,

encircled by a large folded fasciole terminating in a wide siphonal canal notch bordered by a raised edge. Length 84.6 mm., diameter 42 mm.” (Olsson, 1965)

Distribution. A coastal species found between Cabo Camaron, Honduras to Puerto Cabezas, Nicaragua (Petuch, 2013).

Discussion. Olsson compared his new taxon *demarcoi* to *polypleura* which he noted was only known from its figure, however its pattern was “so different from all other members of the genus that it can be accepted for the present as a distinct species.” Olsson opined that the holotype of *polypleura* is “probably in the Paris museum.” This larger, heavier, broader shouldered species also differs from *polypleura* in that it has a strong zoned pattern of large brown blotches, small brown spots, and bands of fine brown lines that have been compared to “music lines or musical staff pattern” encircling the body whorl. Crosse made a point of stating in his description of *V. polypleura* that it did not have the distinctive band of fine brown lines which was characteristic of *V. musica* Linnaeus, 1758 (Crosse, 1876).

Voluta morrisoni (Petuch, 1980)
(Figure 3C)

Holotype. USNM 784485.
Length 73.4 mm.

Description. “Shiny, highly polished; body heavy, thickened, with 4 to 5 whorls; body whorl with 7 to 12 rounded major axial ribs and 30 to 60 sharply defined minor axial ribs; spire elevated, turriculate; shoulder angled with blunt coronations; spire whorls with 3 or 4 raised, beaded spiral cords; protoconch large with 3 bulbous, smooth whorls; aperture elongate, roughly $\frac{2}{3}$ of total shell length; columella with 8 or 9 major plications and 3 to 6 minor plications; plications heavily beaded; outer lip

thickened and flaring in adults; color of base of shell salmon-pink to rose-red with 6 to 8 evenly-spaced revolving bands of black and white spots; base color overlaid with numerous fine red-brown specklings and scattered large dark brown blotches; protoconch salmon-orange; interior of aperture pale pinkish white turning white toward outer lip; columellar region and plications salmon-pink; outer lip white with 11 to 14 raised black denticulations; operculum unknown.” (Petuch, 1980)

Distribution. Endemic to Rosalind and Serranilla Banks between Honduras and Jamaica (Petuch, 2013).

Discussion. Originally named in the genus *Falsilyria* following the trend for fossil species as reflected in Hoerle & Vokes, 1978, as the second known living species in the complex, and is sympatric with *Falsilaria demarcoi* (which was originally named under the genus *Voluta*). Differs from *demarcoi* in that it has a higher spire, more acutely angled shoulder, less numerous and heavily beaded columellar plications, a proportionately larger protoconch, raised beaded cords on the spire, and lacking the bright orange or peach base color, which is characteristic of *demarcoi*. The beaded columellar plications are a unique feature among living species, and closely resemble the beaded plications of the fossil species *F. mansfieldi* (Dall, 1919) (Hoerle & Vokes, 1978; Petuch, 1980).

Voluta garciai (Petuch, 1981)
(Figure 3D)

Holotype. USNM 784641.
Length 63 mm.

Description. “Shiny, polished; heavy body, with 5 whorls; body whorl with 10 rounded axial ribs; all whorls with numerous sharply-defined minor axial ribs; anterior $\frac{1}{4}$ of shell

with 7 large, raised, beaded cords; shoulder sharply defined, strongly coronated; high spire, scalariform; spire whorls coronated, with 7 large, raised, beaded cords; 3 cords on shoulder, enhancing coronated appearance; protoconch glassy, composed of 3 whorls; aperture narrow, roughly $\frac{3}{5}$ of shell length; columella with 9 sharp-edged plications; base shell color cream-orange with 2 bands of deep purple-blue and sky-blue blotches; one band around midbody, one band around anterior end; base color overlaid with numerous longitudinal dark brown zigzag flammules, some running entire length of shell; shoulder with scattered patches of dark brown dots; spire whorls blue-gray with radiating, fine, dark brown zigzag lines, that cross over raised spiral cords, giving them speckled appearance; protoconch tan; interior of aperture flesh-pink; columellar region orange, becoming darker at anterior end.” (Petuch, 1981)

Distribution. Gorda Bank to Trujillo Bay, Honduras (Petuch, 2013; Robert Masino - personal communication).

Discussion. *V. garciai* is the only species in the *V. polypleura* - *demarcoi* complex other than *V. polypleura* with a color pattern of zigzag flammules. It is similar to *V. morrisoni* in that it has heavily sculpted spire whorls and sharp angled shoulder coronations (Petuch, 1981). *V. garciai* appears to be most similar to *V. demarcoi* in both its spire sculpture, cords, and overall color pattern, however like *V. polypleura* it lacks the bands of fine brown lines or “music notes” characteristic of most species in the complex. Since the only known specimens are subadults it is unclear what other features will be apparent in a fully developed adult specimen. With the collection of further specimens and future research *V. garciai* may prove to be most closely related to *V. demarcoi*, having only been geographically isolated since the Pleistocene glacially-induced sea level

fluctuations. It is likely that *V. garciai* is a subspecies of *V. demarcoi* in the process of speciation.

Voluta kotorai (Petuch, 1981)
(Figure 4A)

Holotype. USNM 784642.

Length 49 mm.

Description. “Shiny, polished; heavy body, thickened, with 4-5 whorls; body whorl with 7-10 rounded axial ribs; last whorl with numerous sharply-defined minor axial ribs toward edge of lip; spire low, roughly $\frac{1}{4}$ - $\frac{1}{5}$ total shell length; spire whorls with 3 undulating, beaded spiral cords; protoconch very large for genus, with 3 bulbous whorls; aperture large, wide, lenticular, roughly $\frac{3}{4}$ of total shell length; columella with 12-14 thin, smooth, sharp-edged plications; lip thickened and flaring in adults; base color bright salmon-pink with 2 wide bands of wine-red and purple blotches, one band posterior to midbody line, one anterior; base color overlaid with 5-7 evenly-spaced revolving bands of black and white spots and secondary system of numerous evenly-spaced revolving brown lines connected by short, staggered, longitudinal lines, producing “brick wall” pattern; protoconch white at tip, turning to orange; interior of aperture salmon-pink, becoming orange towards edge of lip; edge of lip white with numerous black spots; columella orange, with white plications.” (Petuch, 1981)

Distribution. Offshore on the Corn and San Andres Islands, Nicaragua, and Gorda, Roncador, Quitasueño, and Serrana Banks (Petuch, 2013).

Discussion. *V. kotorai* differs from *V. demarcoi* in having a proportionately larger protoconch, a lower spire, and lacks both the bright orange-peach base body color and fine brown speckling that is characteristic of *V. demarcoi*. *V. kotorai*

differs from the closely related species *V. retemirabila* in having a proportionately larger protoconch, a red and pink base body color, and in having a coarse “brick” pattern rather than a fine “net” pattern composed of fine brown lines (Petuch, 1981). *V. kotorai* is one of the most distinctive and attractive members of the *V. polypleura - demarcoi* complex.

Voluta retemirabila (Petuch, 1981)
(Figure 4B)

Holotype. USMN 784643.
Length 75 mm.

Description. “Shiny, highly polished; body thick, heavy, with 5 whorls; body whorl smooth, with 11 low, flattened axial ribs; anterior $\frac{1}{4}$ shell with 4 wide, raised spiral cords; shoulder rounded, smooth; spire high; early spire whorls heavily sculpted with raised spiral threads, with later whorls smooth; 3 slightly raised spiral threads on last spire whorl; protoconch glassy, composed of 3 whorls; aperture large, flaring, roughly $\frac{3}{4}$ total shell length; columella with 15 plications, 5 of which are larger than others; base shell color cream-yellow with 2 continuous bands of blue-gray, one above midbody line, one at anterior end; base shell color overlaid with numerous intermeshing, horizontally and vertically-oriented rows of tiny brown dots which form a fine net pattern over entire shell; net pattern, in turn, overlaid by 10 wide, revolving bands of alternating dark brown and violet-blue dashes; protoconch white at tip, turning orange; interior of aperture flesh-colored; columella cream-yellow with white plications.” (Petuch, 1981)

Distribution. Endemic to Misteriosa Bank, between Belize and the Cayman Islands (Petuch, 2013).

Discussion. The protoconch of *V. retemirabila* is larger and more bulbous than *V. demarcoi*,

and smaller than *V. kotorai*. Its fine net pattern and brilliant coloration are unique among the other members of the *V. polypleura - demarcoi* complex.

Voluta harasewychi (Petuch, 1987)
(Figure 3E)

Holotype. USNM 784486.
Length 45 mm.

Description. “Shells small for subgenus, elongated, thickened; body whorl shiny, polished, with few thin, low, axial ribs; shoulder with 8-10 low, rounded knobs; subsutural area with 2-3 large, spiral cords; columella curving at posterior end, with 10-12 thin, heavily pustulated plications; shell white, overlaid with 8-10 evenly-spaced bands of large black and white dashes; spaces between bands of dashes completely covered with tiny, dark brown speckles; speckled and dashed color pattern, in turn, overlain with interrupted bands of flammules of bright red; columella and aperture white; edge of lip with numerous, evenly-spaced black dashes; protoconch large, salmon-orange, dome-shaped.” (Petuch, 1987)

Distribution. Endemic to the north coast of Roatan Island, Honduras (Petuch, 1987; Petuch, 2013).

Discussion. *V. harasewychi* is most closely related to *V. morrisoni*, both of which are the only species in the complex with pustulated columellar plications. However, *V. harasewychi*, has a smoother shell with only a few axial ribs, smaller more rounded shoulder knobs, a much lower spire, a distinctly curved columella, the lip is adherent to the side of the body whorl and does not flare out, and this taxon has a consistently much smaller and stockier shell. *V. harasewychi* also has a sharper, well defined banded color pattern which lacks the large brown color patches seen on *V. morrisoni*.

(Petuch, 1987) The two species appear to be completely geographically isolated.

Voluta hilli (Petuch, 1987)
(Figure 4C)

Holotype. USNM 859871.
Length 88 mm.

Description. “Shell oval in shape, inflated, shiny. With high polish; body whorl ornamented with numerous low axial plications; shoulder with 10-12 large, rounded knobs; spire whorls heavily knobbed; margin of suture bordered with 4 large, raised, spiral cords; columella with 10-12 large plications; often with smaller, secondary plications between; shell base color salmon-pink overlaid with two, wide, bright orange bands, one around mid-body, one around anterior end; wide orange bands overlaid with numerous thin, pale brown spiral lines; base of each shoulder knob with conspicuous, large, dark brown blotch; area between wide orange bands with abundant tiny brown flecks and rows of alternating dark brown and white dashes; columella and aperture bright salmon-pink; edge of lip marked with row of large dark-brown or black checkers; protoconch cylindrical in shape with flattened top, yellow-salmon in color.” (Petuch, 1987)

Distribution. Endemic from the Gorda Bank to the Cajones and Bercero Cays (Petuch, 2013).

Discussion. *V. hilli* is most closely related to *V. demarcoi* but differs in having larger and clearly defined shoulder knobs, having a pale salmon-pink body color, and two wide dark orange bands (Petuch, 1987).

Voluta sunderlandi (Petuch, 1987)
(Figure 4D)

Holotype. USNM 859903.
Length 53 mm.

Description. “Shell small for genus, short and stocky; whorls with 9 large, rounded axial ribs per whorl; axial ribs angled at shoulder, knoblike; subsutural area between shoulder and suture with numerous large, raised spiral cords; anterior end of shell with 6 incised sulci; rest of body whorl smooth, without spiral sculpture; base color white or pale pink with bands of large, evenly-spaced brown dots that are, in turn, separated by 3 evenly-spaced, solid, reddish-brown lines around mid-body; solid mid-body lines connected together by evenly-spaced, large, pale purple spots; columella with 10 large, smooth, plications, with several secondary plications in between; interior of aperture and columella white; protoconch large, rounded, dome-like, white in color.” (Petuch, 1987)

Distribution. Endemic to Utila Island and the adjacent coastline, Honduras (Petuch, 2013).

Discussion. *V. sunderlandi* has the stockiest and most rotund shell in the *V. polypleura* - *demarcoi* complex. *V. sunderlandi* is morphologically closest to *V. demarcoi* and is distinguished by having a smaller more inflated shell, stronger axial ribs and shoulder knobs, lower spire, fewer and coarser columellar plications, white or pinkish-white base color, narrower and less developed mid-body color band, and white protoconch (Petuch, 1987).

Voluta ernesti (Petuch, 1990)
(Figure 4E)

Holotype. USNM 860539.
Length 54 mm.

Description. “Shell narrow, elongated, fusiform, thick and heavy; spire elevated, protracted; spire whorls slightly convex in outline; whorls ornamented with 8-10 large, rounded, axial plications; large plications overlaid with numerous thin, riblike plications; shoulder angled, bordered by a single large spiral cord;

subsutural areas sculptured with 3 large spiral cords; subsutural spiral cords intersect with thin axial riblets to produce beaded texture on shoulder and spire; body whorl shiny, polished; anterior end sculptured with 5-6 spiral cords; columella slightly arcuate, with 11-12 thin, smooth plications; outer lip of adults thickened, projecting posteriorward; protoconch proportionately large, rounded, domelike; shell color pale salmon-yellow with 2 wide bands of brown and purple checkers and spots, one around mid-body and one around anterior end; mid-body band overlaid with 4-6 brown spiral hairlines and numerous tiny brown vertical flammules; anterior band similarly marked with 5 brown hairlines and tiny vertical flammules; salmon-yellow areas between wide colored bands completely overlaid with closely-packed, tiny orange-brown speckles; protoconch light tan; columella and interior of aperture pale salmon; edge of lip yellowish-white, marked with evenly-spaced dark brown spots." (Petuch, 1990)

Distribution. Found between Punta Gorda, Honduras and the San Blas Islands, Panama (Petuch, 2013).

Discussion. Inhabiting the Blasian Subregion *V. ernesti* is the southernmost taxon in the *V. polypleura* - *demarcoi* complex. *V. ernesti* is most similar to *V. demarcoi* and is distinguished by its smaller, slender, elongated shell, more sharply-angled shoulder, and less colorful pale salmon-yellow base color compared with the consistent deep orange base color of *V. demarcoi* (Petuch, 1990).

Voluta "brunneocincta" Poppe, 2001
(nomen nudum - not figured)

Distribution. From Roatan, Honduras.

Discussion. *V. "brunneocincta"* was not described or named as a species, but rather was

a form name applied to a dark variant *V. hilli* specimen found at the northern end of its range. This name has been incorrectly used in the popular literature as though it were a formally named species. An beautiful specimen of this color form is figured by Guido Poppe in his book "Exceptional Shells from the Guido T. Poppe Collections" (Poppe, 2001).

DISCUSSION

These ten taxa in the *Voluta polypleura* - *demarcoi* complex are poorly known due to their isolated habitat, and the lack of any serious coordinated effort to study them in their natural environment. Most specimens of these extraordinary volutes only come to the surface as part of the bycatch of shrimp trawlers and lobster fishermen who work vast areas of the sea to catch food for human consumption, and notoriously provide misleading locality data in an effort to protect their rich fishing grounds. Accordingly, locality data on the specimens acquired through trawlers is often inaccurate at best.

The misplacement of the type specimen of *V. polypleura* Crosse, 1876, for well over 140 years, together with inaccurate locality data for the types of both *V. polypleura* and *V. demarcoi*, and the paucity of specimens available for study contributed to the confusion regarding the *Voluta polypleura* - *demarcoi* complex. These factors, combined with difficulties in obtaining copies of scientific literature, poor quality images in older journals, and difficulty in viewing type specimens for study has only perpetuated the problem among collectors and in the popular literature (Poppe & Goto, 1992; Bail & Poppe, 2001).

Further, the fact that photographs of the holotypes of these species have not been widely disseminated, combined with the fact that specimens are scarce due to their isolated

habitat, has led to the assumption that they are all merely color forms of *V. polypleura*. The advent of the internet, and museum databases with online access and high quality macro photographic images has opened the opportunity for taxonomic studies. High quality photographs of the holotypes of all ten species are shown together in Figures 3 and 4. Finally, setting aside the unique species specific color patterns and looking at shell sculpture alone, the author has provided a detailed side by side diagnostic comparison of the morphological differences between the ten species in the *Voluta polypleura* - *demarcoi* complex. (Table 1)

An understanding of these organisms' breeding habits, bathymetric preferences, and the biogeographic distribution of these mollusks is critical. A bathymetric color scale map showing the offshore banks, seamounts, cays, and islands where these species have been found is shown for reference. (Figure 5) Like most volutes these shallow water taxa are direct developers with nonplanktonic larvae. Given the oceanographic topography and the locations where these organisms have been found it is clear that most of them are geographically isolated on offshore banks and seamounts. The *Voluta polypleura* - *demarcoi* complex is the Caribbean parallel to the East Australian *Cymbiola* "pulchra complex" in this regard as it is comprised of a series of adjacent populations, geographically delimited and without noticeable overlap (Bail & Limpus, 1998). Only two of these volutid species have a coastal distribution: *V. demarcoi* and *V. ernesti*. In practical terms this means that each of the populations of these shallow water volutes are unable to interbreed with one another as they are surrounded by deep oceanographic barriers to dispersal. Accordingly, these populations have become genetically isolated and have evolved into closely related allopatric species over the last several million years.

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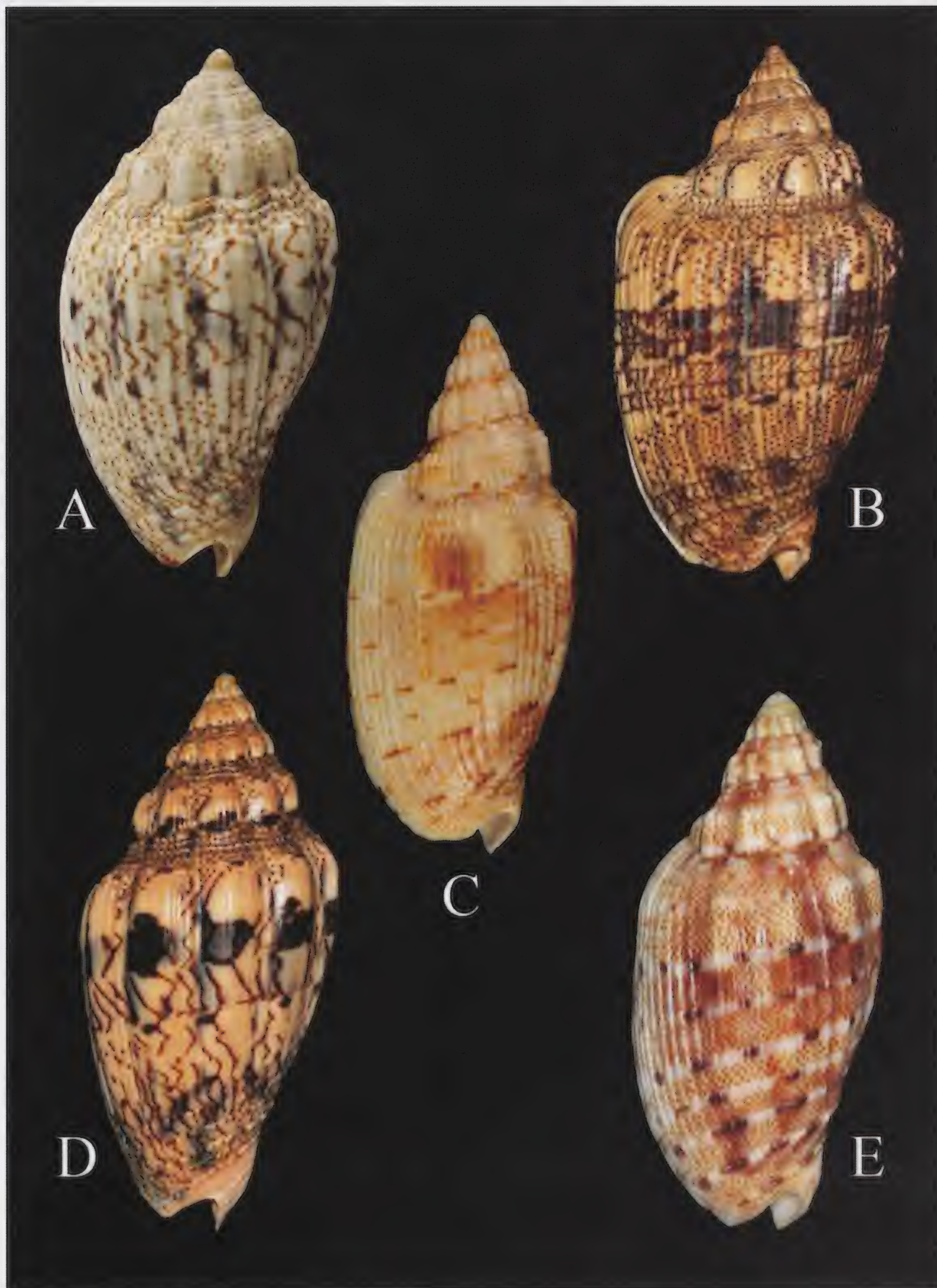


Figure 3. A = *V. polypleura* Crosse, 1876, holotype 56 mm; B = *V. demarcoi* Olsson, 1965, holotype 84.6 mm; C = *V. morrisoni* (Petuch, 1980), holotype 73.4 mm; D = *V. garciai* (Petuch, 1981), holotype 63 mm; E = *V. harasewychi* (Petuch, 1987), holotype 45 mm. All specimens are shown the same size in this figure for comparison.

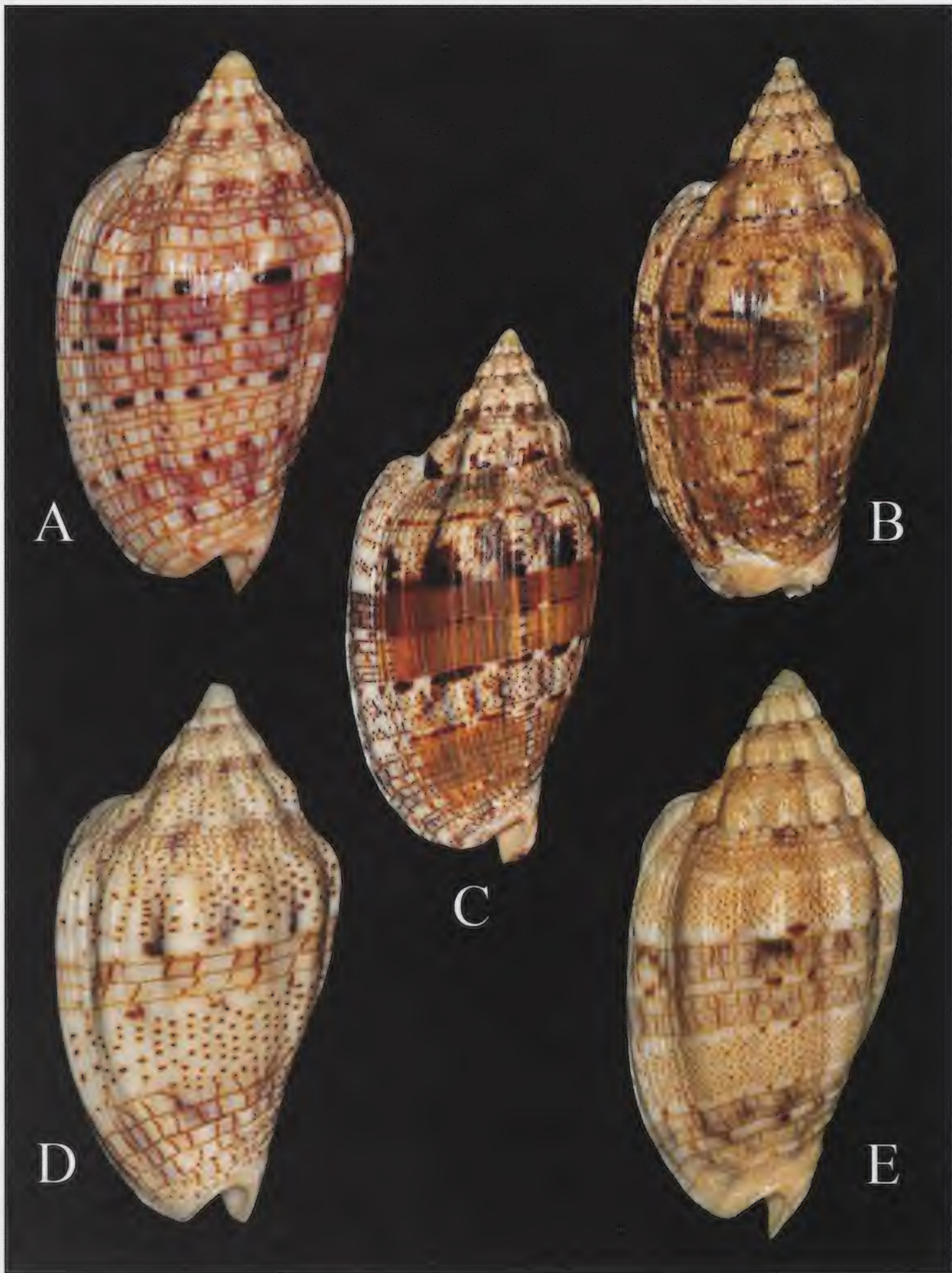


Figure 4. A = *V. kotorai* (Petuch, 1981), holotype 49 mm; B = *V. retemirabila* (Petuch, 1981), holotype 75 mm; C = *V. hilli* (Petuch, 1987), holotype 88 mm; D = *V. sunderlandi* (Petuch, 1987), holotype 53 mm; E = *V. ernesti* (Petuch, 1990), holotype 54 mm. All specimens are shown the same size in this figure for comparison.

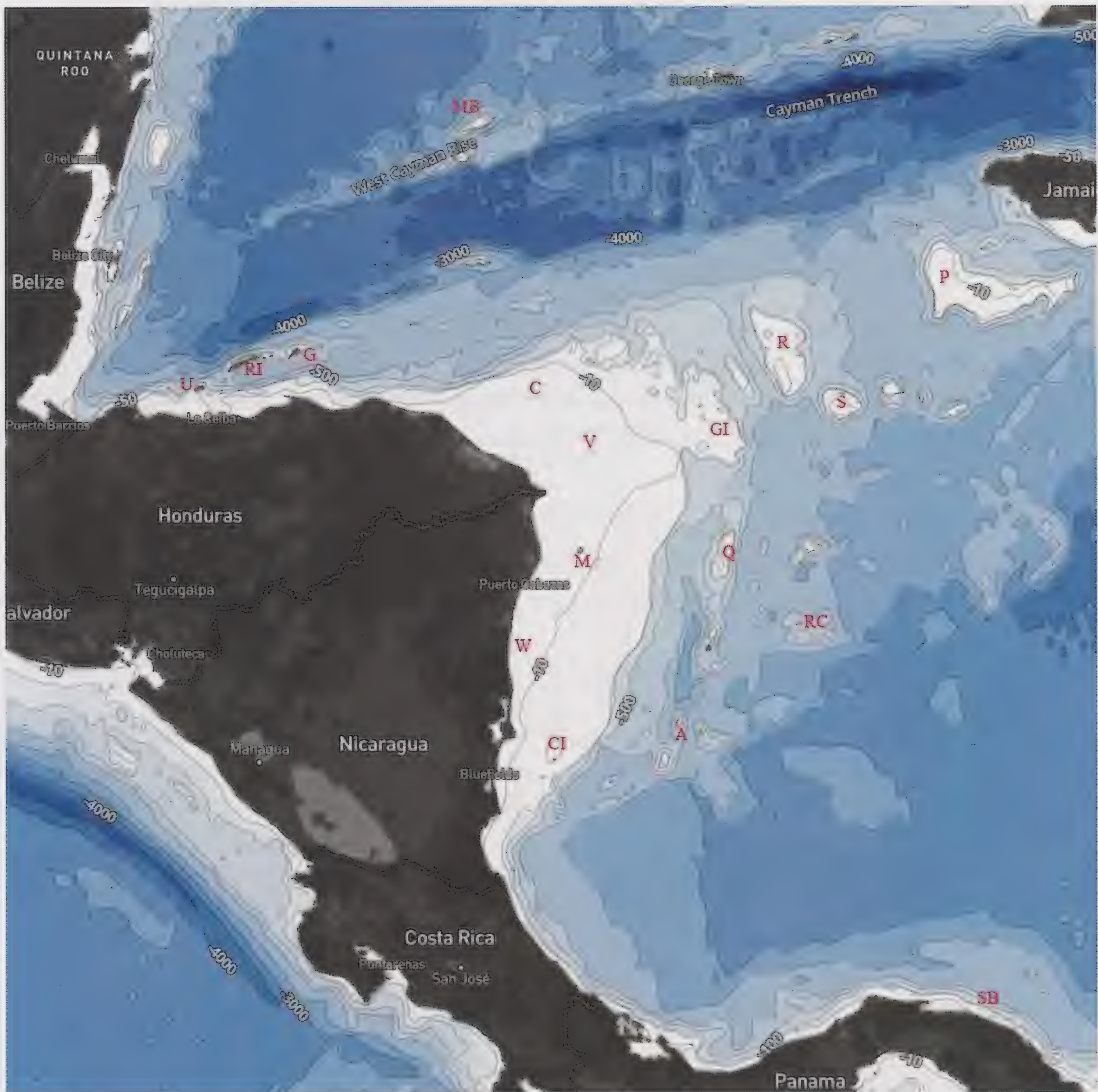
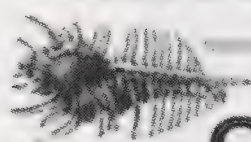


Figure 5. Bathymetric Color Scale Map of the Nicaraguan Subprovince of the Caribbean Province. Depth is noted in meters at contour lines. Some of the important geographic features of the area, north to south, are: MB = Misteriosa Bank; U = Utila Island; RI = Roatan Island; GI = Guanaja Island (The Bay Islands); C = Caratasca Cay; V = Vivorillos Cays; G = Gorda Bank; R = Rosalind Bank; S = Serranilla Bank; P = Pedro Bank; M = Miskito Cays; W = Wawa River mouth; Q = Quitasueño Bank; RC = Roncador Bank; A = Albuquerque Cays; CI = Corn Island; SB = San Blas Islands. (Adapted from a Topographic Bathymetry / Global Thematic Map, on www.tcarta.com - fair use doctrine claimed.)

Species	Protoconch	Spire	Whorls	Shoulder	Subsutural area	Columella sculpture
<i>polypleura</i>	3 whorls, bulbous, large, tan-brown	High	8-9 axial ribs, rounded	Weak, smooth rounded	Weak, 3-4 coarse large cords	8 major & 3 minor smooth plications
<i>demarcoi</i>	1.5 whorls, bulbous, large, rosy-brown	Slightly elevated	8 smooth axial ribs, rounded	Broad, 8 knobs, rounded	Sharp, 3 coarse large spiral cords	14 smooth plications
<i>morrisoni</i>	3 whorls, Smooth, bulbous, large., salmon-orange	Elevated	7-12 axial ribs, 30+ minor ribs	Angled, w/ blunt knobs	3-4 raised, beaded spiral cords	8-9 major w/ 3-6 minor plications
<i>garciai</i>	3 whorls, glassy, tan	High	10 axial ribs, many minor ribs	Sharply defined, w/ 3 cords	7 lg. beaded cords	9 sharp plications
<i>kotorai</i>	3 whorls, bulbous, large, white	Low	7-10 axial ribs, many minor ribs	Smooth, rounded	3 beaded spiral cords, undulating	12-14 thin plications
<i>retemirabila</i>	3 whorls, glassy, white	High	11 low flat axial ribs	Smooth, rounded	4 wide and raised spiral cords	15 plications, 5 of which are larger
<i>harasewychi</i>	3 whorls, dome shaped, large, white	Average	Thin low axial ribs / grow lines	Indistinct, 8-10 knobs, rounded	2-3 large spiral cords	10-12 thin pustulated plications
<i>hilli</i>	2 whorls, cylindrical, flattened top, yellow-salmon	Average	Numerous low axial ribs	10-12 large rounded knobs	4 large raised spiral cords	10-12 major, w/ mid minor plications
<i>sunderlandi</i>	1.5 whorls, flattened Dome shaped, large, white	Low	9 large axial ribs	Rounded, knob-like ribs	Numerous large raised spiral cords	10 major w/ mid minor plications
<i>ernesti</i>	2.5 whorls, dome-like, large, rounded, yellow-gold	Elevated	8-10 axial ribs, many minor ribs	Angled w/ single lg. cord	3 lg. spiral cords, w/ ribletts	11-12 thin plications

Table 1. Comparison of the morphological differences between the ten species in the *Voluta polypleura* - *demarcoi* complex

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